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ABSTRACT

A mother's interactions with her young daughter were studied with special emphasis placed upon the frequencies of linguistically instructional input and the strategies employed to provide this information. The girl was between 18 and 28 months old and her mean length of utterance (MLU) was between 1.5 and 4.3 morphemes. Only maternal input was analyzed. Taxonomies and frequency data were established. After demonstrating through independently established data that frequencies of input are of considerable importance for the order of acquisition of specific linguistic skills, observed sample frequencies and estimated overall frequencies were computed. Between 600 and 1,700 items of linguistically instructional input per hour were observed in the various transcribed samples, which leads to an estimate for total instructional input of around 300,000 items per month and around 3,500,000 per year. The instructional techniques that could be categorized and differentiated amounted to around 400 per hour and an estimate of around 115,000 per month. Input frequencies might therefore be important factors in first language acquisition. (Author/RH)

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The mother of Eve --

as a first language teacher.*

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Paper presented at the Biennial Meeting of the Society for Research in Child Development, San Francisco, March, 1979.

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Abstract

Maternal language teaching was studied with special emphasis placed upon the frequencies of linguistically instructional input and the strategies employed to provide this information. The interactions between a girl and her mother were analyzed. The girl was between 18 and 28 months old and her MLU was between 1.5 and 4.3 morphemes. Only maternal input was analyzed. Taxonomies and frequency data were established. After demonstrating through independently established data that frequencies of input are of considerable importance for the order of acquisition of specific linguistic skills, observed sample frequencies and estimated overall frequencies were computed. Between 600 and 1,700 items of linguistically instructional input per hour were observed in the various transcribed samples, which leads to an estimate for total instructional input of around 300,000 items per month and around three and a half million per year. The instructional techniques that could be categorized and differentiated amounted to around 400 per hour and an estimate of around 115,000 per month. Input frequencies might therefore be important factors in first language acquisition.

The mother of Eve --

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During the last decade, it has been clearly demonstrated that mothers adapt their speech to the linguistic level of their young children. Yet the question as to whether these adaptations serve also a teaching function is still open and sceptical appraisals are found in some of the most recent discussions (Newport, Gleitman & Gleitman, 1977). The evidence to be presented in this paper pertains directly to this controversy. For the clarification of the argument to be presented a brief theoretical and conceptual specification is first required: It is argued that the value of maternal speech adaptations for the child's language acquisition is relatively independent of whether mothers are aware of their instructional activities and whether they teach intentionally. Teaching/learning is defined on the basis of the input structure and its effects, that is, objectively, and not on the basis of intent. It may predominantly be incidental. From a more process-oriented perspective, teaching/learning is seen as an almost unavoidable consequence of the communicative setting. In order to convey messages to their children mothers have to encode them in a form the children can grasp, i.e., analyze. And the children have to analyze the messages to understand them. Mothers may do this at first by incorporating the verbal message into a highly informative nonverbal informational context, with some verbal elements even being redundant. In this manner the child can analyze the parallels between surface structure of the message and the meaning structure that is conveyed. As soon

as mothers attempt to convey messages that are not fully or even only minimally supported by the nonverbal context, the verbal message structure itself has to be made obvious enough for the child to be analyzed for its informational content. If the mother finds that her initial attempt at encoding, i.e., communicating, was not obvious enough, she engages in a large variety of build-up, break-down, frame variation, replacement, and other repair sequences to mend the gap in the flow of communication. The qualitative and quantitative recording of these techniques and of the linguistic information conveyed thereby is the main goal of the present report.

METHODOLOGY

As the title suggests, the subjects of the study are Eve and her mother interacting with each other, as observed, recorded, and transcribed by Roger Brown and associates. Brown recorded the interactions over a period of around 11 months, when Eve was between 18 and 28 months old. Eve's MLU as ascertained by Brown (1973) ranged between 1.5 and 4.3. The present analyses were made from the written transcripts. Hours of interaction were selected from the entire set of transcripts by choosing as a rule the first recorded hour of each sample. Transcripts with abnormally large amounts of input coming from observers were however replaced by more normal interaction sessions. Only maternal input was coded and included in the tabulations in Tables 3 to 5. Since either the observers, or the father, or both interacted with Eve in every session, the input is not described exhaustively but only in regard to 'the mother of Eve'. For Tables 1 and 2 the input supplied by both parents was tabulated by Brown.

RESULTS

The present report is a progress report of a study under way. It will therefore only present input data, though it is fully admitted that interactional data contribute more to the understanding of language development. The interactional data will be presented in a forthcoming report. The input will be described structurally, i.e., qualitatively, in two ways: A taxonomy of specific types of linguistic information conveyed by the mother will be presented first, which is then followed by a taxonomy of instructional techniques employed by the mother to help the child analyze and abstract the linguistic information provided. This qualitative presentation will be supplemented by a quantitative one, consisting of frequency data for each type of category abstracted and presented. Since much emphasis will be placed upon the density and the total amount of instructional activity going on between mother and child, a justification for this emphasis upon frequencies is required. This is especially important, since input frequency has been neglected or declared unimportant in much of the past literature.

Tables 1 and 2, which are taken from another study (Moerk, forthcoming) are intended to provide the required justification showing that input frequency deserves at least close scrutiny as one important variable contributing to language acquisition.

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Insert Table 1 about here

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The data in Table 1 are taken from Brown (1973); they pertain to all three of Brown's subjects. The morphemes for which input frequency

and age of criterion are given are those that were the first ones mastered after the date Brown computed input frequencies. Choosing a relatively brief time span between establishment of input frequencies and age of mastery, it is relatively certain that the input frequencies did not change profoundly; such a change would obviously lead to spurious results.

Table 1 shows that the correlations between input frequencies and the children's attainment of criterion (which is 90 percent correct in obligatory context according to Brown's definition) range from around .55 to around .75. The variance in temporal order of acquisition accounted for by input frequency ranges, consequently, from a low of around 30 percent to a high of almost 55 percent. The percentages certainly present an impressive argument for the possible impact of input frequencies.

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Insert Table 2 about here

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Table 2 serves mainly to reaffirm the conclusion derived from Table 1. It provides further evidence specifically for Eve and her parents' input frequencies in regard to various prepositional phrases containing the preposition <u>in</u>. The overall data show that frequency of parental modeling is strongly related to the frequencies with which Eve attempts a construction -- even if incorrectly -- and to the correct provision of the morpheme in obligatory contexts. The one apparently contradicting item under Samples 7-12 is only an apparent exception.

It is due to a change in input frequencies in the long interval between the time Brown tabulated the input frequencies and the observed output frequencies in samples 7 to 12. A detailed analysis of the table and the problem of time-lag analyses is given in Moerk (forthcoming).

Having plausibly demonstrated the importance of input frequencies, the actual frequencies for a wide variety of linguistic inputs provided by Eve's mother deserve to be studied. They are summarized in Table 3.

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Insert Table 3 about here

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Table 3 contains information on the actual counted frequencies, with which the 19 types of linguistic information were encountered in the specified transcripts of Brown. In the rightmost column, the total amount of categorized linguistic input is recorded for the same transcripts. Four sources of underestimation of the frequencies have, however, to be taken into account: a) Most phonetic/phonological aspects could not be sufficiently differentiated on the basis of the transcripts only. In addition, the investigator does not have the specific training required for an exhaustive phonetic/phonological analysis. b) Observer and paternal inputs were not included in the counts, though these two types of interaction partners provided models and feedback quite similar in content and structure as the mother's. c) Very simple aspects that were obviously and fully mastered by Eve were not counted anymore for the tabulation of the frequencies. Since they were fully

mastered, they did not represent instructionally important input. Examples of these items are: The concord between That and is or It and is; the concord between I and am and You and are (the singular form, since the plural you are was almost never used); the noun-pronoun equivalence Mummy-I and Eve-you. d) Finally, a detailed analysis of transcripts as rich as Brown's confronts the investigator with such a wealth of data, that it is impossible to exhaustively categorize them in a first attempt. Other investigators will certainly conceive of additional categories and will therefore obtain larger overall frequencies of instructional input. Having pointed out these limitations in the frequency counts, it is possible to let Table 3 speak for itself. The wealth of information in Table 3 is too large to be discussed in detail and the message it conveys is also clear enough: The density of linguistic input provided to Eve per hour of recorded interaction is very impressive indeed, ranging from a minimum of around 600 items to almost 1700 items, i.e., from around 10 per minute to almost 30 per minute. It would be highly astonishing if an intelligent child would not be able to abstract and store information from input so massively provided.

In arguing from the input frequencies to their effects one profound problem is, however, encountered. Table 3 contains the data on selected samples of mother-child interactions only, but information about the total linguistic input would obviously be desirable for an argument about input effects. In Table 4 it is attempted to provide estimates about the 'population frequencies' of Eve's input from the frequencies of non-random 'samples'. The terms 'population' and 'sam-

ple' pertain obviously in this context not to subjects but to hours of input.

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Insert Table 4 about here

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Since it is at least probable that during the prearranged recording sessions the mother of Eve interacted with Eve more intensively than during the normal course of the day, the danger of overestimating the total frequencies per day, week, and month is obviously great. To counteract this danger, a very conservative estimate was made. In calculating input frequencies per day, the average hourly frequencies were multiplied by a factor of only ten, although the waking day of a two to three-year-old child is obviously longer than 10 hours. As discussed in connection with Table 3, four additional sources of underestimation are encountered for the frequencies provided in this table, so that five sources of underestimation are contrasted with one source of overestimation. No research is known to the author exploring how frequencies during recording sessions relate to frequencies of input during the normal day-to-day interactions. The provided estimates represent therefore only approximations, and a considerable error range has to be presumed.

Keeping in mind this limitation of the estimates, the data can be evaluated regarding their import. The overall significance is quite immediately obvious. The frequencies are astonishingly large, e.g., the number of 'trials' experienced by the child during the course of one month is impressive indeed, as suggested by the Total Input of

around 300,000 items. If an estimate of the entire linguistic input for the period of one year is considered, the resulting number is around three and a half million. With such frequencies, even a possible overestimation of up to 25 percent would be theoretically and practically relatively inconsequential.

This information, though impressive indeed, is however only half of the important evidence. Table 5 presents the other aspect concerning the techniques the mother of Eve uses in conveying the above-described linguistic information.

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Insert Table 5 about here

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The techniques are labelled in the boxheads of Table 5; the headings are mostly self-explanatory, and they are generally known from the pertinent literature, so that they need not be explained in detail. Since research on specific instructional techniques is comparatively recent, it is almost certain that several or many techniques have not yet been recognized and therefore could not be included in the suggested taxonomy. The frequencies of 'Total Techniques' in the rightmost column represent therefore almost certainly an underestimation. Nevertheless, the frequencies in the 'Total Techniques' column and also in some of the specific categories are quite large. A closer study of Table 5 would reveal some trends with age or language level, low frequencies in a few categories, and contrasts between quite uniform distributions across the samples and wide intersample variations. These phenomena suggest close adaptation of maternal input techniques to the child's linguistic

level, her informational, and motivational needs. This adaptedness will be demonstrated in forthcoming analyses of the interaction processes.

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Insert Table 6 about here

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Table 6, finally, provides a few examples of some of the teaching techniques and the contents taught through them. In the rightmost column, several interpretative remarks are provided. It is however readily admitted, that these remarks are by no means exhaustive or linguistically definitive. These few examples may, nevertheless, provide an impression of the wealth of information, and the analytical possibilities presented in the input, as well as of the challenge awaiting future research in this field.

CONCLUSIONS

The conclusions have to remain partial, since the study is still in a preliminary stage and many aspects await completion. The most obvious suggestion of the present report is that the input is overwhelmingly rich, linguistically very informative, and astonishingly well structured. A young child that has for one to two years abstracted regularities from perceptual input, could barely fail abstracting regularities, i.e., linguistic rules, also from this input. Any theory that stresses the complexity of the linguistic input and puts forth the argument that the young child is not ready to deal with these complexities, neglects one important fact of maternal input as suggested in Tables 5 and 6: The child does not need to spontaneously perform complex analyses of new linguistic input, since the mother is doing it for him by

employing a wide variety and a large number of instructional techniques. If Maratsos (1979), for example, argued that single maternal examples are ambiguous, he overlooked the fact that most of the mothers studied rarely gave single examples in teaching-learning situations, but strings of systematically varied examples. The examples are thereby arranged so that content and structure are varied interdependently, and that the structure underlying the message sequence becomes highly obvious. Table 6 suggests that this applies equally to phonological, morphological, and syntactic structures. The next step in the research enterprise will be to show how children utilize the information provided for immediate learning, for rehearsal, and for generalization to new instances. Some aspects of this research will be reported shortly in a fuller report pertaining to Brown's transcripts. An in-depth exploration of it will however require considerable time and more preliminary work.

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Table 1

Correlations Between Parental Input Frequency and Age of Mastery of Specific Morphemes

Eve			Adam			Sarah		
Morpheme	Parental Frequency	Age of Criterion/MS	Morpheme	Parental Frequency	Age of Criterion/MS	Morpheme	Parental Frequency	Age of Criterion/MS
Present Progressive	67	22	Present Progressive	65	30	Plural[a]	57	34
on	32	22.5	in	37	31	in	20	35
in	40	23	on	20	32	on	16	35
	$r = -.736$		Plural[a]	57	32	Present Progressive	28	36
	$r^2 = .54$			$r = -.56$		Past Irregular	45	36.5[b]
				$r^2 = .31$		Possessive	16	37
							$r = -.658$	
							$r^2 = .43$	

[a]Allomorphs were not differentiated.

[b]The Past Irregular was not included in the calculation of the correlation coefficient, since it appears in many and widely differing forms. An overall frequency count is therefore psychologically meaningless.

Table 2

Relationships Between Frequencies of Parental Modeling and Eve's Production of Prepositional Phrases Containing the Preposition *in*.

N of Constructions	Samples 1-6 Parental Frequency	Samples 1-6 Eve's Frequencies C/I[a,b]	C/I / N	Success Rate: C/I	Samples 7-12 Eve's Frequencies C/I	C/I / N	Success Rate: C/I
19	0	0/0	0 / 0	0	45/1	2.37 /.05	45
14	1-2	1/8	.07/ .57	.125	10/6	.717/.42	1.67
14	≥3	5/25	.35/1.78	.200	92/5	6.57 /.35	18.4
			x^2 = 45.47			x^2 = 77.92	
			p < .001			p < .001	

[a] C = correct production

[b] I = incorrect production

Table 3

Recorded sample frequencies of various types of linguistic input provided by Eve's mother.

Sample	Hour	S-V-(O) sentences	Copula sentences	Questions	Complex sentences	Concord	SNP: 1 element	SNP: ≥2 elements	VP: Full Verb only	VP: Full Verb + Auxiliaries	QNP: 1 element	QNP: ≥2 elements	PPhs	Adverbials	Plural: Regular nouns	Plural: Pronouns	Possession: Saxon Genitive	Possession: Pronouns	N - Pr Equivalence	Modality	Total input
1	1	100	40	65	17	27	77	9	45	54	19	46	35	9	10	5	8	16	21	76	679
3	1	85	40	35	15	23	76	0	55	40	30	26	29	39	1	15	6	14	19	91	639
5	1	87	82	61	22	35	67	5	45	48	26	32	80	77	11	7	9	29	38	81	802
7	1	167	76	80	29	67	122	4	87	79	56	69	60	56	11	12	30	34	26	159	1224
9	1	128	34	51	23	34	97	4	69	58	53	45	42	45	11	15	7	26	15	118	875
11	1	83	36	42	16	32	74	1	41	39	31	34	35	32	4	12	0	12	17	77	618
13	1	154	66	33	44	43	130	2	68	93	57	62	52	37	39	22	2	30	28	179	1141
15	1	249	95	121	65	48	188	6	101	139	78	70	95	26	24	42	5	36	28	274	1690
17	3	181	64	88	58	29	124	7	78	108	68	59	79	67	17	19	1	39	22	188	1296
19	1	180	91	71	54	62	149	1	71	113	55	51	57	42	11	32	3	23	28	155	1249

Table 4

Estimated population frequencies of various types of and of overall linguistic input provided by Eve's mother.

Time unit	S-V-(O) sentences	Copula sentences	Questions	Complex sentences	Conjoined	SNP		VP		ONP	
						1 element	≥2 elements	Full Verb only	Full Verb + Auxiliaries	1 element	≥2 elements
Per hour	141	62	65	34	40	110	4	66	77	47	49
Per day	1414	624	647	343	400	1104	39	660	771	473	494
Per week	9898	4368	4529	2401	2800	7728	273	4620	5397	3311	3458
Per month	42420	18720	19410	10290	12000	33120	1170	19800	23130	14190	14820

Time unit	PPhs	Adverbials	Plural		Possession		N - Pr Equivalence	Modality	Total input in all counted categories
			Regular nouns	Pronouns	Saxon Genitive	Pronouns			
Per hour	56	39	14	18	7	26	24	140	1019
Per day	564	390	139	181	71	259	242	1398	10213
Per week	3948	2730	973	1267	497	1813	1694	9786	71491
Per month	16920	11700	4170	5430	2130	7770	7260	41940	306390

Table 5

Recorded and estimated frequencies of various types of instructional techniques employed by Eve's mother.

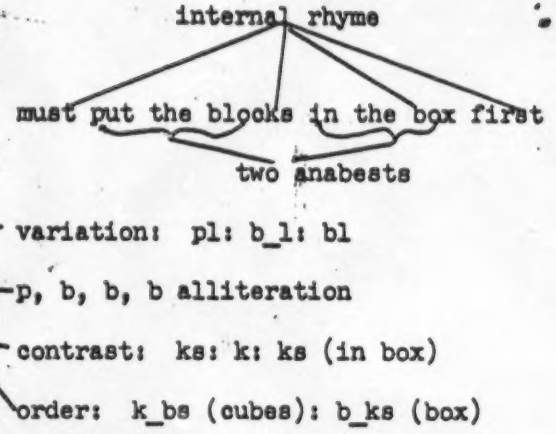
Sample	Hour	Disapproval	Imitation	Expansion	Incorporation	Replacement sequence	Frame variation	Opt. transformation	Contrast	Clarification	Parallels	Amplification	Self-repetition	Reinstatement	Phonetic patterns	Guiding question	Linguistic testing	Total techniques
1	1	0	15	22	39	36	7	18	46	12	20	14	14	22	42	28	8	343
3	1	0	13	17	14	27	10	15	35	11	14	9	24	10	39	28	5	271
5	1	2	19	45	28	33	9	16	44	10	34	12	36	19	67	28	4	406
7	1	1	14	61	28	38	22	22	68	16	21	17	25	39	84	32	9	497
9	1	8	16	38	10	26	15	26	67	8	27	12	16	14	58	22	0	363
11	1	1	7	21	8	21	13	25	55	9	22	12	8	19	47	23	2	293
13	1	3	16	29	9	22	14	37	40	16	16	23	22	19	81	15	9	371
15	1	14	48	45	5	47	13	50	43	19	22	16	32	14	120	48	14	550
17	3	5	33	14	6	30	9	31	43	19	14	14	34	10	104	33	2	401
19	1	14	40	33	9	26	8	38	43	13	23	16	18	13	69	19	11	393
$\bar{X}$/hour		5	22	33	16	31	12	28	48	13	21	15	23	18	71	28	6	389
$\bar{X}$/day		48	221	325	156	306	120	278	484	133	213	145	229	179	711	276	64	3888
$\bar{X}$/week		336	1547	2275	1092	2142	840	1946	3388	931	1491	1015	1603	1253	4977	1932	448	27216
$\bar{X}$/month		1140	6630	9750	4680	9180	3600	8340	14520	3990	6390	4350	6870	5370	21330	8280	1920	116640

Table 6

Some examples of instructional contents and methods.

1. Phonetic/phonemic aspects:

M. You must put the blocks in the box first,
before you can play with the buillion cubes.
.....
You can play with the buillion cubes,
if you put the blocks back in the box.


internal rhyme
must put the blocks in the box first
two anabests
← variation: pl: b_l: bl
←p, b, b, b alliteration
contrast: ks: k: ks (in box)
order: k_bs (cubes): b_ks (box)

(Note also the repetition of the message with variations: First the message retains the same temporal structure as the intended behavior, then it is reversed in a conditional construction.)

2. Bound morphemes:

Plural:

C. Soldier. M. Yes, there's soldiers on the radio. There's two soldiers.
C. Soldier. M. Soldiers. Uh huh. Two soldiers.

Note the four corrective models; the redundant encoding of the plural (two + -s); the mother's blunting of the critical force of her corrections through two conditioned reinforcers (yes, huh).

Past:

M. I know you spilled it, because you shook it.

3. Sentence constituents:

Prepositional Phrase:

M. There is a cookie on the table
in the room
on the table
with the rest
of your cookies.
anabests

Repetition plus gradual replacement sequence. Note how cookie/cookies frame the sequence.

4. Various sentence forms and constituents:

M. Mr. Fraser doesn't have a hat.
He doesn't have a hat.
He would like to have Eve's hat.
He would.
He would like to have it on.
....(Sentences with want)
Mr. Fraser doesn't have a hat.
Eve has a hat.

Note the repetitions/reinstatement with gradual replacements of the elements. All three major constituents are systematically varied; possession is expressed through have and the Saxon Genitive; shortly before it was encoded through possessive pronouns; like to have and want are alternated.